WHAT IS CLAIMED IS:

1. A sense layer for a magnetic memory element, said sense layer comprising:

a first magnetizable layer with a magnetic moment oriented in a first direction;

a second magnetizable layer with a magnetic moment oriented in a second direction opposite to said first direction;

a spacer layer formed between said first and second magnetizable layers;

said layers being formed of a material and thickness sufficient to provide stray field coupling between said first and second layers across said spacer layer such that said first and second layers have magnetic moments oriented antiparallel to each other; and

said layers being formed of a material and thickness sufficient to provide antiferromagnetic exchange coupling between the first and second layers across said spacer layer such that the magnetic moments of the first and second layers are free to rotate substantially simultaneously in the presence of an applied magnetic field so that the first and second magnetic moments of the magnetizable layers can be oriented in the other of said first and second directions.

2. A sense layer of claim 1 further comprising:

a thinner layer, relative to the first magnetizable layer, of Co interposed between the spacer layer and the first magnetizable layer; and

a thinner layer, relative to the second magnetizable layer, of Co interposed between the spacer layer and the second magnetizable layer.

3. A sense layer of claim 1 further comprising:

a thinner layer, relative to the first magnetizable layer, of CoFe interposed between the spacer layer and the first magnetizable layer; and

a thinner layer, relative to the second magnetizable layer, of CoFe interposed between the spacer layer and the second magnetizable layer.

4. A sense layer of claim 1 wherein the first and second magnetizable layers comprise at least one layer of NiFe.

5. A sense layer of claim 1 wherein the first and second magnetizable layers comprise at least one layer of CoFe.

6. A sense layer of claim 1 wherein the first and second magnetizable layers comprise at least one layer of Co.

7. A sense layer of claim 1 wherein the first and second magnetizable layers comprise at least one layer of Fe.

8. A sense layer of claim 1 wherein the first and second magnetizable layers comprise at least one layer of Ni.

9. A sense layer of claim 1 wherein the first and second magnetizable layers comprise at least one layer of NiFeCo.

10. A sense layer of claim 1 wherein the spacer layer thickness is such that the antiferromagnetic exchange coupling between the first and second magnetizable layers has

a magnetic field value which is less than the coercive field value of that one of the first and second magnetizable layers with the largest coercive field value.

11. A sense layer of claim 1 where the first magnetizable layer has a magnetic saturation times first layer thickness which is not equal to magnetic saturation times second layer thickness of the second magnetizable layer.

12. A sense layer of claim 1 where the spacer layer is a conductive material.

13. A sense layer of claim 1 where the spacer layer comprises an Ru layer.

14. A sense layer of claim 1 where the spacer layer comprises a Cu layer.

15. A method of claim 1 wherein said spacer layer is a conductor that is not ferromagnetic or antiferromagnetic.

16. A sense layer of claim 1 where the first and second magnetizable layers are formed of different materials having the same thickness.

17. A sense layer of claim 1 where the first and second magnetizable layers are formed of different material, each having a thickness different from the other.

18. A sense layer of claim 1 wherein said layers are formed in an elliptical pattern.

19. A sense layer for a magnetic memory element, said sense layer comprising:

a first magnetizable layer having a first material composition, a thickness t1 and a magnetic moment oriented in a first direction;

a second magnetizable layer over said first magnetizable layer, said second magnetizable layer having said first material composition and a thickness greater than t1 and a magnetic moment oriented in a second direction opposite said first direction;

a conductive spacer layer formed between said first and second magnetizable layers;

said first and second magnetizable layers and conductive spacer layer being formed to provide stray field coupling between said first and second layers such that said first and second layers having magnetic moments oriented anti-parallel to each other; and

said first and second magnetizable layers and conductive spacer layer each being formed of a material and thickness sufficient to provide antiferromagnetic exchange coupling having a value greater than 0 and <= 200 Oe between the first and second layers across said spacer layer, the magnetic orientation of said first and second layers rotating substantially simultaneously in the presence of an applied magnetic field.

20. A sense layer of claim 19 wherein the spacer layer thickness is such that the antiferromagnetic exchange coupling between the first and second magnetizable layers is less than the coercive (H) field value of the one of the first or second magnetizable layer which has the largest coercive field value.

21. A magnetic memory structure comprising:

a sense layer comprising:

a first magnetizable layer with a magnetic moment oriented in a first direction;

a second magnetizable layer with a magnetic moment oriented in a second direction opposite to said first layer;

a spacer layer formed between said first and second magnetizable layers;

said layers being formed of a material and thickness sufficient to provide stray field coupling between said first and second magnetizable layers such that said first and second magnetizable layers have magnetic moments oriented anti-parallel to each other;

said layers being formed of a material and thickness sufficient to provide antiferromagnetic exchange coupling between the first and second layers such that the magnetic moments of the first and second layers are free to rotate substantially simultaneously in the presence of an applied magnetic field so that the first and second magnetic moments of the magnetizable layers can be oriented in the other of said first and second directions;

a pinned layer; and

a tunneling barrier formed from a non-magnetic material provided between said sense layer and said pinned layer.

22. A magnetic memory structure of claim 21 wherein antiferromagnetic exchange coupling between the first and second magnetizable layers across said spacer layer is between 0 and <= 200 Oe.

23. A magnetic memory structure of claim 21 further comprising a row line conductor coupled to provide a magnetic field to said sense layer and a column line conductor to provide a magnetic field to said sense layer, wherein said pinned layer has a magnetic field orientation which is substantially within 15 degrees of an axis of said row line when antiferromagnetic exchange coupling between the first and second layers across said spacer layer is greater than 0 and <= 100 Oe.

24. A magnetic memory structure of claim 21 wherein the spacer layer thickness is such that the antiferromagnetic exchange coupling between the first and second magnetizable layers across the spacer layer is less than the coercive field value of the one of the said first or second magnetizable layer which has the largest coercive field value.

25. An array of magnetic memory elements comprising:

a substrate;

a first set of substantially parallel electrically conductive lines formed on the substrate;

a second set of substantially parallel electrically conductive lines formed on the substrate substantially orthogonal to the first set of conductive lines and which intersect with the first set of conductive lines;

a plurality of magnetic memory elements, each said each element formed between and coupled to the first and second conductive line intersection points, said elements comprising a magnetic memory sense layer comprising:

a first magnetizable layer with a magnetic moment oriented in a first direction;

a second magnetizable layer with a magnetic moment oriented in a second direction opposite to said first direction;

a spacer layer formed between said first and second magnetizable layers;

said layers being formed of a material and thickness sufficient to provide stray field coupling between said first and second layers across said spacer layer such that said first and second layers have magnetic moments oriented antiparallel to each other; and

said layers being formed of a material and thickness sufficient to provide antiferromagnetic exchange coupling between the first and second layers across said spacer layer such that the magnetic moments of the first and second layers are free to rotate substantially simultaneously in the presence of an applied magnetic field so that the first and second magnetic moments of the magnetizable layers can be oriented in the other of said first and second directions.

26. An array of magnetic memory elements of claim 25 further comprising another conductive line situated near said sense layer which is used to read the magnetic orientation of said sense layer magnetic moments.

27. An array of magnetic memory elements of claim 25 further comprising another conductive line situated near said sense layer which is used to rotate substantially simultaneously the magnetic moments of said first and second magnetizable layers.

28. An array of magnetic memory elements of claim 25 further comprising another conductive line which runs through said sense layer and is used to determine magnetic orientation of said sense layer magnetic moments.

29. An array of magnetic memory elements of claim 25 further comprising another conductive line which runs through said sense layer and is used to rotate

substantially simultaneously the magnetic moments of said first and second magnetizable layers.

30. A computer system comprising:

a processor;

a magnetic memory device electrically coupled to the processor, said memory device comprising:

a first magnetizable layer with a magnetic moment oriented in a first direction;

a second magnetizable layer with a magnetic moment oriented in a second direction opposite to said first direction;

a spacer layer formed between a first and second magnetizable layers;

said layers being formed of a material and thickness sufficient to provide stray field coupling between said first and second layers such that said first and second layers have magnetic moments oriented antiparallel to each other; and

said layers being formed of a material and thickness sufficient to provide antiferromagnetic exchange coupling between the first and second layers such that the magnetic moments of the first and second layers are free to rotate substantially simultaneously in the presence of an applied magnetic field so that the first and second magnetic moments of the magnetizable layers can be oriented in the other of said first and second directions.

31. A computer system of claim 30 wherein the array of magnetic memory devices are electrically coupled to the processor through a memory controller and bus.

32. A computer system of claim 30 wherein the spacer layer thickness is such that the antiferromagnetic exchange coupling between the first and second magnetizable layers across the spacer layer is less than the coercive field value of the one of the said first or second magnetizable layer which has the largest coercive field value.

33. A magnetic memory structure comprising:

a sense layer comprising:

a first magnetizable layer with a magnetic moment oriented in a first direction;

a second magnetizable layer with a magnetic moment oriented in a second direction opposite to said first layer;

a spacer layer formed between said first and second magnetizable layers;

said layers being formed of a material and thickness sufficient to provide stray field coupling between said first and second magnetizable layers such that said first and second magnetizable layers have magnetic moments oriented anti-parallel to each other;

said layers being formed of a material and thickness sufficient to provide antiferromagnetic exchange coupling between the first and second layers such that the magnetic moments of the first and second layers are free to rotate substantially simultaneously in the presence of an applied magnetic field so that the first and second magnetic moments of the magnetizable layers can be oriented in the other of said first and second directions;

a pinned layer; and

a conductive layer provided between said sense layer and said pinned layer.

34. A sense layer of claim 33 further comprising:

a thinner layer, relative to the first magnetizable layer, of Co interposed between the spacer layer and the first magnetizable layer; and

a thinner layer, relative to the second magnetizable layer, of Co interposed between the spacer layer and the second magnetizable layer.

35. A sense layer of claim 33 further comprising:

a thinner layer, relative to the first magnetizable layer, of CoFe interposed between the spacer layer and the first magnetizable layer; and

a thinner layer, relative to the second magnetizable layer, of CoFe interposed between the spacer layer and the second magnetizable layer.

36. A magnetic memory structure of claim 33 wherein antiferromagnetic exchange coupling between the first and second magnetizable layers across said spacer layer is between 0 and <= 200 Oe.

37. A magnetic memory structure of claim 33 further comprising a row line conductor coupled to provide a magnetic field to said sense layer and a column line conductor to provide a magnetic field to said sense layer, wherein said pinned layer has a magnetic field orientation which is substantially within 15 degrees of an axis of said row line when antiferromagnetic exchange coupling between the first and second layers across said spacer layer is greater than 0 and <= 100 Oe.

38. A magnetic memory structure of claim 33 wherein the spacer layer thickness is such that the antiferromagnetic exchange coupling between the first and second

magnetizable layers across the spacer layer is less than the coercive field value of the one of the said first or second magnetizable layer which has the largest coercive field value.

39. A method for manufacturing a magnetic memory element comprising:

forming a pinned or reference layer with a magnetization in a first direction over a substrate;

forming a tunnel barrier layer over the pinned layer; and

forming a sense layer over the tunnel barrier layer, said sense layer having a first and second ferromagnetic layer separated by a spacer layer and a characteristic which results in stray field coupling and antiferromagnetic exchange coupling between said first and second ferromagnetic layers.

40. A method of claim 39 wherein the act of forming said sense layer further comprises:

forming said first magnetization layer over the tunnel barrier layer;

forming a spacer layer over the first magnetization layer; and

forming the second magnetization layer over the spacer layer.

41. A method of claim 40 further comprising smoothing a surface of the pinned layer before forming another layer on said pinned layer.

42. A method of claim 40 further comprising smoothing the first magnetization layer before forming a spacer layer.

43. A method of claim 40 wherein said first and second magnetizable layers are formed of a material comprising NiFe.

44. A method of claim 40 wherein said first and second magnetizable layers are formed of a material comprising CoFe.

45. A method of claim 40 wherein said first and second magnetizable layers are formed of a material comprising Co.

46. A method of claim 40 wherein said first and second magnetizable layers are formed of a material comprising Fe.

47. A method of claim 40 wherein said first and second magnetizable layers are formed of a material comprising Ni

48. A method of claim 40 wherein said first and second magnetizable layers are formed of a material comprising NiFeCo.

49. A method of claim 40 wherein said spacer layer comprises a Ru layer.

50. A method of claim 40 wherein said spacer layer comprises a Cu layer.

51. A method of claim 40 wherein said spacer is a conductor that is not ferromagnetic or antiferromagnetic.

52. A method of claim 40 wherein said spacer layer is formed with a thickness such that the antiferromagnetic exchange coupling between said first and second

magnetizable layers is less than the coercive (H) field value of the one of the first or second magnetizable layer which has the largest coercive field value.

53. A method of claim 40 where forming said layers is such that the layers are formed of a material and thickness sufficient to provide stray field coupling and antiferromagnetic exchange coupling, said antiferromagnetic exchange coupling is within the range of 0 to <= 300 Oe between the first and second layers across said spacer layer.

54. A method of claim 40 wherein said step of forming the first and second magnetization layers includes forming said first and second layers including NiFe.

55. A method of claim 40 wherein second layer is formed with a thickness t and first layer is formed with a thickness greater than t.

56. A method of claim 40 further comprising:

forming a thinner layer, relative to the first magnetizable layer, of Co interposed between the spacer layer and the first magnetizable layer; and

forming a thinner layer, relative to the second magnetizable layer, of Co interposed between the spacer layer and the second magnetizable layer.

57. A sense layer of claim 40 further comprising:

forming a thinner layer, relative to the first magnetizable layer, of CoFe interposed between the spacer layer and the first magnetizable layer; and

forming a thinner layer, relative to the second magnetizable layer, of CoFe interposed between the spacer layer and the second magnetizable layer.

58. A method for manufacturing a magnetic memory element comprising:

forming a sense layer over a substrate, said sense layer having a first and second ferromagnetic layer separated by a spacer layer and a characteristic which results in stray field coupling and antiferromagnetic exchange coupling between said first and second ferromagnetic layers across said spacer layer;

forming a tunnel barrier layer over the sense layer; and

forming a pinned or reference layer with a magnetization in a first direction over a said tunnel barrier.

59. A method of claim 58 wherein the act of forming said sense layer further comprises:

forming said first magnetization layer over the tunnel barrier layer;

forming a spacer layer over the first magnetization layer; and

forming the second magnetization layer over the spacer layer.

60. A method of claim 58 wherein said spacer layer is formed with a thickness such that the antiferromagnetic exchange coupling between said first and second magnetizable layers is less than the coercive (H) field value of the one of the first or second magnetizable layer which has the largest coercive field value.

61. A method of claim 58 where forming said layers is such that the layers are formed of a material and thickness sufficient to provide stray field coupling and antiferromagnetic exchange coupling, said antiferromagnetic exchange coupling is greater than 0 and <= 200 Oe between the first and second layers across said spacer layer.

62. A method of claim 58 wherein second magnetizable layer is formed with a thickness t and first magnetizable layer is formed with a thickness greater than t.

63. A method for manufacturing a magnetic memory element comprising:

forming a pinned or reference layer with a magnetization in a first direction over a substrate;

smoothing a surface of the pinned layer;

forming a tunnel barrier layer over the pinned layer; and

forming a sense layer over the tunnel barrier layer, said act of forming said sense layer comprising:

forming said first magnetization layer over the tunnel barrier layer;

smoothing the first magnetization layer;

forming a spacer layer over the first magnetization layer;

forming a second magnetization layer over of the spacer layer;

said first and second magnetization layers and spacer layer being formed such that said layers are stray field coupled and antiferromagnetic exchange coupled across said spacer layer;

said first and second magnetizable layer are formed having a magnetic saturation times said first layer's thickness which is not equal to said second layer's magnetic saturation times second layer thickness of the second magnetizable layer.

64. A method of claim 63 wherein said spacer layer is formed with a thickness such that the antiferromagnetic exchange coupling between said first and second magnetizable layers is less than the coercive (H) field value of the one of the first or second magnetizable layer which has the largest coercive field value.

65. A method of claim 63 wherein sense layer is formed having antiferromagnetic exchange coupling between first and second magnetization layer of more than zero and less than a value which prevents magnetic orientation switching of said sense layer in the presence of an applied magnetic field.

66. A method of claim 63 wherein said first magnetization layer, spacer layer and second magnetization layer are formed of materials and thickness' sufficient to provide stray field coupling and antiferromagnetic exchange coupling between said first and second magnetizable layers and across said spacer layer, said antiferromagnetic exchange coupling is greater than 0 <= 200 Oe.

67. A method of claim 63 wherein the second magnetization layer is formed with a thickness t and first layer is formed with a thickness greater than t.

68. A method for manufacturing a magnetic memory element comprising:

forming a pinned or reference layer with a magnetization in a first direction over a substrate;

forming a conductive layer over the pinned layer for creating a giant magnetoresistance effect; and

forming a sense layer over the tunnel barrier layer, said sense layer having a first and second ferromagnetic layer separated by a spacer layer and a characteristic which results in stray field coupling and antiferromagnetic exchange coupling between said first and second ferromagnetic layers.

69. A method of claim 68 wherein the act of forming said sense layer further comprises:

forming said first magnetization layer over the tunnel barrier layer;

forming a spacer layer over the first magnetization layer; and

forming the second magnetization layer over the spacer layer.

70. A method of claim 68 where forming said layers is such that the layers are formed of a material and thickness sufficient to provide stray field coupling and antiferromagnetic exchange coupling, said antiferromagnetic exchange coupling is within the range of 0 to <= 300 Oe between the first and second layers across said spacer layer.

71. A method of claim 68 wherein second layer is formed with a thickness t and first layer is formed with a thickness greater than t.

72. A sense layer of claim 68 wherein the pinned layer is a synthetic ferrimagnet.